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Committee on the Peaceful Uses of Outer Space

Report on the United Nations International Conference on Space-based Technologies for Disaster Risk Reduction: Building Resilience through Integrated Applications

(Beijing, 23–25 October 2017)

I. Introduction

1. In its resolution 61/110, the General Assembly decided to establish a programme within the United Nations to provide to all countries and relevant international and regional organizations universal access to all types of space-based information and services relevant to disaster management in order to support the full disaster management cycle by serving as a gateway to space information for disaster management support, as a bridge to connect the disaster management and space communities and as a facilitator of capacity-building and institutional strengthening, in particular for developing countries. The Assembly agreed that the programme should be named the United Nations Platform for Space-based Information for Disaster Management and Emergency Response (UN-SPIDER).

2. The United Nations International Conference on Space-based Technologies for Disaster Risk Reduction is the annual event of the UN-SPIDER programme of the Office for Outer Space Affairs of the Secretariat. It has been held in Beijing since the establishment of the UN-SPIDER Beijing Office in 2011. The 2017 Conference was held from 23 to 25 October 2017 and was co-organized by UN-SPIDER and the Ministry of Civil Affairs of China in collaboration with the Ministry of Foreign Affairs of China, the China National Space Administration and the Asia-Pacific Space Cooperation Organization (APSCO).

3. The 2017 Conference brought together 90 participants representing organizations such as civil protection, national disaster management and national space agencies, research institutions, science and technology agencies, non-governmental organizations and private entities.

4. A total of 58 organizations from the following 32 countries were represented at the 2017 Conference: Austria, Bangladesh, Cambodia, China, Ethiopia, Fiji, Georgia, Ghana, India, Indonesia, Iran (Islamic Republic of), Italy, Japan, Kenya, Lao People's Democratic Republic, Mongolia, Mozambique, Myanmar, Nepal, Nigeria, Oman, Pakistan, Peru, Singapore, Sri Lanka, Sudan, Thailand, Turkey, United Kingdom of Great Britain and Northern Ireland, United States of America, Viet Nam and Zimbabwe.

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5. Following the Conference, 24 of the participants were provided with a one-week training course on integration of multi-source Earth observation data for disaster damage assessment, which was organized by UN-SPIDER, APSCO and the National Disaster Reduction Centre of China and held at the Regional Centre for Space Science and Technology Education for Asia and the Pacific, located at Beihang University in Beijing.

6. The conferences have covered various themes based on the current issues and needs of countries identified in the course of UN-SPIDER technical advisory activities. Those activities are aimed at enabling Governments to make effective use of space-based information in disaster risk reduction and emergency responses, and form the UN-SPIDER contribution to the activities of the Office for Outer Space Affairs. They are one concrete element in the development of stronger space governance and supporting structures in the run-up to the 2018 thematic cycle of the Committee on the Peaceful Uses of Outer Space, dedicated to the fiftieth anniversary of the United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE+50).

7. Previous conferences covered best practices for risk reduction and rapid response mapping (2011), risk assessment in the context of global climate change (2012), disaster risk identification, assessment and monitoring (2013), multi-hazard disaster risk assessment (2014), a consolidating role in the implementation of the Sendai Framework for Disaster Risk Reduction 2015–2030 (2015), and understanding disaster risks (2016). The conferences have provided a forum for disaster management communities and experts to strengthen their capabilities in using space-based information to identify, assess, monitor and respond to disaster risks and integrate space technology into long-term disaster risk management efforts.

8. The theme of the 2017 Conference was “Building resilience through integrated applications”, which is one of the important elements of thematic priority 6 of UNISPACE+50, on international cooperation towards low-emission and resilient societies.

9. The Conference marked another step in the long-term efforts of the Office for Outer Space Affairs and its UN-SPIDER programme to build on the commitments of the Sendai Framework and the 2030 Agenda for Sustainable Development through UNISPACE+50.

10. The Conference brought together national organizations involved in disaster management and the generation of geospatial information in the countries where UN-SPIDER technical advisory support had been provided or was offered. The Conference was also attended by representatives of UN-SPIDER regional support offices, various regional and international organizations, and experts from centres of excellence in different parts of the world.

II. Background and objectives

11. Member States are engaged with and acting upon three important global frameworks, namely, the 2030 Agenda for Sustainable Development, the Sendai Framework for Disaster Risk Reduction 2015–2030 and the Paris Agreement, which was signed at the twenty-first session of the Conference of the Parties to the United Nations Framework Convention on Climate Change. To support Member States in these endeavours, the Office for Outer Space Affairs is preparing for UNISPACE+50. Thematic priority 6 of UNISPACE+50 is closely linked to UN-SPIDER, through which the Office addresses developing countries’ limited access to specialized technologies that can be essential in the management of disasters and in reducing disaster risks and promotes coordinated efforts within the United Nations, in order to accomplish the common disaster risk reduction, humanitarian and climate change goals.

12. One of the objectives of thematic priority 6 is to improve approaches to integrated space applications and the interoperability of space-based and ground/in situ systems. For planning and response to be effective, space-based solutions must be integrated into decision-making. Such integration must be supported by outreach activities aimed at increasing the awareness of decision makers of the benefits of space-based solutions.

13. The Conference was aimed at providing a platform to share experiences and gather new ideas on integrating space applications in support of efforts to reduce disaster risk, including tools and technologies, as well as peripheral issues such as data sharing, spatial data infrastructure, institutional coordination, all of which are needed to achieve the targets of the Sendai Framework. Experiences and recommended practices in that context were shared by the panellists and discussed by all participants.

14. The participants of the 2017 Conference built upon the outcomes of conferences in 2015 and 2016 and elaborated the role of Earth observation in the implementation of the Sendai Framework for Disaster Risk Reduction 2015–2030.

15. The main aims of the Conference were to provide a forum for the sharing of thoughts and ideas and to facilitate the formulation of programmes to support the following outcomes:

(a) Combined and complementary use of space-based technologies and in situ information in disaster risk reduction applications to increase the understanding of disaster risk and its drivers;

(b) Improved partnerships in support of efforts to integrate the use of space technologies in single- and multi-hazard early warning systems, including those focused on climate-influenced disasters such as floods and droughts;

(c) Development of applications that integrate Earth observation, global navigation satellite systems and telecommunication constellations for disaster risk reduction and climate change monitoring, mitigation and/or adaptation, promoting integrated development where relevant;

(d) Contributions to the preparations for UNISPACE+50, which in turn was to contribute to the global frameworks, namely, the 2030 Agenda for Sustainable Development, the Sendai Framework and the Paris Agreement.

III. Programme

16. Five plenary meetings, six parallel breakout meetings and two institutional visits were held. A total of 45 presentations were given during the plenary and breakout meetings, on the following topics:

(a) Plenary meeting 1. Policy and institutional arrangements for integrating “space” into disaster risk reduction decision-making:

(i) Parallel meeting 1.1. Policy integration and institutional arrangements at the national level for leveraging the potential of “space” in disaster risk reduction decision-making;

(ii) Parallel meeting 1.2. “Space” in national, regional and international institutions and frameworks contributing to disaster risk reduction decision-making;

(b) Plenary meeting 2. Integration of space and in situ data for disaster risk reduction:

(i) Parallel meeting 2.1. Trends in access to and availability of space and in situ data;

(ii) Parallel meeting 2.2. Best practices in data integration for disaster risk reduction;

(c) Plenary meeting 3. Technology integration for disaster risk assessment and emergency response:

(i) Parallel meeting 3.1. Advances in risk assessment methods, tools and systems;

(ii) Parallel meeting 3.2. Integrated emergency response tools and systems;

(d) Plenary meeting 4. Integrated applications of Earth observation, the global navigation satellite system and telecommunication constellations for disaster risk reduction and climate change-related extreme hazards;

(e) Plenary meeting 5. Networking and engagement with the UN-SPIDER network.

17. On the last day of the Conference, institutional visits were paid to the Exhibition Centre of China Academy of Space Technology and to the National Disaster Reduction Centre of China.

IV. Programme of activities

A. Policy and institutional arrangements for integrating “space” into disaster risk reduction decision-making

18. Plenary meeting 1 and parallel meetings 1.1 and 1.2 of the Conference were focused on policy and integration at the institutional level related to disaster risk reduction decision-making. It was noted that, given the growing number of disaster management organizations that were using space-based Earth observation data and geographic information systems for disaster management, the challenge was in supporting the integration of space-based data into decision-making through relevant policies and institutional partnerships. At the national level, disaster management agencies worked with multiple stakeholders to evaluate the need for information related to disaster risk reduction, to obtain access to Earth observation and in situ data and to integrate data in order to disseminate such information and derive products from it. Similarly, partnerships were needed at the regional and international levels, because disaster risk reduction issues went beyond geo- and sociopolitical boundaries. In the decision-making process, it was important to ensure that information products were utilized in combination with in situ data.

19. At the international level, the role played by the European Union Copernicus Emergency Management Service (Copernicus EMS), the International Charter on Space and Major Disasters and UN-SPIDER was highlighted. It was noted that Copernicus EMS and the International Charter were mechanisms that demonstrated an excellent integration of institutions, space resources, products, systems, and operational mechanisms and polices that enabled Member States to access such services. Through its technical advisory missions, UN-SPIDER had facilitated the development of policy and institutional arrangements in Member States that enabled them to take full advantage of space-based information. It had also played a crucial role in sharing best practices in the international community with national stakeholders. The experiences gathered by the UN-SPIDER programme informed the way forward in addressing thematic priority 6 of UNISPACE+50.

20. China was presented as an example of a country that had given due attention to national policies and institutional arrangements for developing integrated applications and making practical use of space in disaster risk reduction efforts. The country’s new national plan included working guidelines on disaster risk reduction that acknowledged the integral role of space in disaster risk reduction. The policies and practices related to integrating space in disaster risk reduction in Fiji, Mongolia and Viet Nam were also presented.

21. There were numerous policy and administrative challenges that delayed the effective interoperability and integration of geospatial information products and

systems. Participants shared views and ideas on operational policies and data-sharing protocols to remove major obstacles in providing emergency managers with timely access to accurate information products derived from space and geospatial technologies. In that connection, dialogue and communication among different stakeholders were crucial at both the national and international levels. International mechanisms and platforms such as UN-SPIDER, the International Charter and Copernicus EMS had been highly valued for their function as networks for and bridges between data providers, experts and decision makers. It was hoped that such mechanisms and platforms would play an increasingly greater role in the integration of space into disaster risk reduction efforts.

22. In a participatory exercise on challenges in the use of technology for multi-agency collaboration, conducted during the parallel meetings, it was found that authorities in different developing countries were attempting to address technology-based disaster risk reduction and response activities in isolation and that they tended to focus on their own organization's Earth observation policy objectives, rather than on the collective objectives of achieving the Sustainable Development Goals and the targets of the Sendai Framework in their countries. Participants noted that many past Earth observation-based projects had struggled to achieve their objectives owing to the lack of a common understanding and approach.

B. Integration of space and in situ data for disaster risk reduction

23. At plenary meeting 2 and parallel meetings 2.1 and 2.2, recent trends in and approaches to data integration were discussed in the context of promoting the collection, processing, management and dissemination of data while taking into account user needs. It was noted that the elements of disaster risk, such as hazards, exposure and vulnerability, were assessed on the basis of space-derived and other data of a heterogeneous nature. Such data were available from multiple sources and were scattered among different locations. Along with advancements in space technology, the types and quantity of data being gathered were increasing dramatically. However, space-based information alone was not sufficient for reducing disaster risks; therefore, integrating space data with in situ data was an effective way to better utilize data to support decision-making related to risk reduction. Data acquisition from aerial platforms had also improved in terms of availability and affordability.

24. It was noted that, to improve resilience to and preparedness for disasters, it was essential to take a holistic approach that integrated space and in situ data. The increasing use of satellite-derived products and information for monitoring environmental phenomena and natural events, such as that related to oceans, flood and water management, and agricultural or drought monitoring, was gaining popularity. At the same time, in situ data were required for the development of products and the calibration and validation of their related data sets. One major challenge was integrating and handling the huge amount of data collected from satellites and in situ observations, and in making the data available to users through user-friendly interfaces.

25. The initiatives presented in the meeting demonstrated the benefits of integrating space-based and in situ data. They included the National Database for Emergency Management of India, the National Disaster Management Plan of Pakistan, the ThinkHazard! project, the World Bank Open Data for Resilience Initiative, the in situ component of the Copernicus EMS and the DroughtWatch 3.1 tool developed by the Chinese Academy of Sciences.

26. It was noted that platforms such as OpenAerialMap and Copernicus Reference Access Data were being developed to facilitate access to in situ data for end users such as disaster managers, research scientists and policymakers, and the platforms also addressed related data policy and licensing issues. The future enhancement of such platforms and systems — those based on space and in situ data — could be realized through closer cooperation between emergency management actors and

technical experts and by considering the requirements of end users. Crowdsourced information was becoming a new source of in situ data.

27. Participants of the parallel breakout meetings showcased several operational applications and recommended practices that had exploited new trends in access to and availability of space and in situ data.

C. Technology integration for disaster risk assessment and emergency response

28. Plenary meeting 3 was dedicated to technology integration for disaster risk assessment aimed at promoting solution-driven innovations and identifying related gaps and challenges. It was noted that risk assessment was one of the basic approaches to understanding risk. Various methodologies, models and tools had been developed for risk assessment that addressed single or multiple disasters. The methodologies were based on the type of hazard and exposure as measured on a temporal and spatial scale and often did not use Earth observation data effectively. Developing uniform methods for risk assessment based on Earth observation data, whether at the local, national, regional or global level, was a challenge, in particular owing to the availability of multiple types of data (e.g., multispectral, hyperspectral, microwave, etc.) and resolutions.

29. Technology integration should serve the purpose of providing meaningful information at the right time for effective decision-making. In that regard, the 72-hour approach developed by the World Food Programme had been successfully applied in six countries across the Asia-Pacific region. The approach was aimed at transforming the concept of post-disaster assessment by providing an immediate initial assessment of the likely impact of a disaster and, hence, the concomitant assistance needs. It served to fill the most urgent information gaps that could arise when disaster hit by providing a snapshot of the location of the impact, the number of people affected and to what extent they had been affected.

30. The National Emergency Operations Centre in India was showcased as an initiative that comprehensively addressed all issues of collaboration, convergence, networking and integration of Earth observation and communication technologies under one umbrella in order to facilitate effective disaster risk reduction and emergency response operations. The initiative envisaged the participation of several authorities and stakeholders in a multilateral arrangement, in particular agencies with expertise in the use of Earth observation technologies and in activities related to early warning, relief and rescue, and mitigation. The country’s existing national database for emergency management was broad-based, with capacity for multiple application modules to facilitate the integration of security-related modules and call centres employed in the operation of the state-of-the-art operations centre.

31. It was noted that the participation of the private sector was needed, in particular to build resilience in urban areas, as industries had the potential to collect, analyse and disseminate scientific data using modern technologies for the purpose of vulnerability profiling, which was a need in fast-developing cities.

32. The development of technology should be demand-driven and include the integration of relevant disciplines such as meteorology, climatology and coastal zone management as necessary elements in understanding risks.

D. Integrated applications of Earth observation, the global navigation satellite system and telecommunication constellations for disaster risk reduction and climate change-related extreme hazards

33. Plenary meeting 4 was focused on integrated applications of space technologies (Earth observation, navigation and telecommunication) needed to address the broader issues concerning disaster risk reduction and climate change-related extreme hazards.

It was noted that the experiences in addressing climate variability and extreme weather events, irrespective of their attribution to climate change, held valuable lessons for reducing vulnerability and enhancing resilience to future climate-related adverse impacts. It was pointed out that the Sendai Framework highlighted the importance of addressing climate-related risks as a part of disaster risk reduction efforts. There was increasing focus on building resilience into investments and development. The integrated application of various space technologies could address the gaps in knowledge about climate change-related issues and their implications for sustainable development.

34. It was noted that continued research on and capacity-building in the use of promising technologies, in particular synthetic aperture radar systems, was needed, as such technologies had shown promising results with respect to immediate warning and damage and disaster impact assessment.

35. Emerging techniques must find a way into the greater sphere of planning and risk reduction, as they could provide the greatest return on investment. Integration of various Earth observation technologies with other space technologies such as global navigation satellite systems in the development of tools to help with land-use planning was but one example.

36. Satellite and related geospatial technologies must be employed in standardized ways that meet the needs of end users and the environments in which they operated.

37. Challenges existed in efforts to increase the scope of event warning and detection activities that use Earth observation systems in order to include greater geographical extents and multiple hazards in ways that usefully connected a broad spectrum of end users.

E. Networking and engagement with the UN-SPIDER network

38. Plenary meeting 5 was dedicated to networking and engagement with the UN-SPIDER network. The objectives of the meeting were to provide insight into the activities supported by UN-SPIDER in partnership with national disaster management agencies, to discuss the ways and means of making those activities more effective and relevant to the needs of the Member States, and to enhance the engagement of Member States and partner organizations with UN-SPIDER.

39. It was noted that, with the support of Member States, regional support offices and other partners, UN-SPIDER had been able to build a wide network of governmental agencies, international and regional organizations, non-governmental organizations, scientific organizations, private companies and other stakeholders. UN-SPIDER had carried out several technical advisory missions, capacity-building programmes and outreach activities in Asia and the Pacific, Africa and Latin America.

40. Representatives of the following regional support offices provided updates: the International Centre for Integrated Mountain Development and the Asian Disaster Reduction Centre. The representatives of the Lao People's Democratic Republic and Sri Lanka described the impact of those countries' joint efforts with UN-SPIDER. In addition, the representative of the Regional Centre for Space Science and Technology Education for Asia and the Pacific, hosted by Beihang University in Beijing, provided updates on the activities of the Regional Centre.

41. Participants drew attention to the enormous contributions made by UN-SPIDER in the previous 11 years, and by the UN-SPIDER Beijing Office in the previous 7 years, in the areas of raising the awareness of disaster management stakeholders at the highest levels in several Governments of the need to use space-based information, training government officials on a wide range of technology applications, generating technical materials, guides and handbooks, and addressing the gap between policy and coordination related to the use of Earth observation in disaster management.

42. Representatives of Member States and regional support offices proposed activities that UN-SPIDER could potentially carry out in the coming years.

V. Observations and recommendations

43. The recommendations formulated at the Conference were in line with thematic priority 6 of UNISPACE+50, on international cooperation towards low-emission and resilient societies. The Conference explored a specific dimension of thematic priority 6 by focusing on the combined and complementary use of space-based technologies and in situ information to increase the understanding of disaster risk.

44. It was noted that the disaster management sector, being interdisciplinary in nature, needed robust policies to address access to data, licensing, data sharing and dissemination, the formats of value-added products and institutional arrangements at the national and international levels, with specific focus on space-based tools, systems and information. The Conference confirmed the crucial role of UN-SPIDER in working with national disaster management agencies as an adviser on the development of policies that integrate Earth observation data, geospatial information and in situ information derived from multiple sources. The Conference advocated the formulation of such integrative policies to strengthen resilience to disasters.

45. The Conference recommended the integration of space and in situ data for the purposes of disaster risk reduction, and this was promoted at the Conference through the showcasing of tools designed specifically for particular hazards, as well as systems developed for multi-hazard risk assessment and preparedness. The increasingly prominent role of aerial data obtained from unmanned aerial vehicles was also showcased and was seen as having added a new dimension to the collection of much-needed information for disaster management. It was noted that better resilience to and preparedness for disasters could be strengthened by integrating space and in situ data, such as that related to oceans, flood and water management, and agricultural or drought monitoring, for the purpose of monitoring natural events.

46. The Conference recommended the development of online platforms that bring together state-of-the-art technologies to facilitate access to in situ data for end users. It also envisaged future enhancements of such platforms and systems based on space and in situ data, which were possible through closer cooperation between emergency management actors and technical experts and by taking into consideration the requirements of end users.

47. The Conference recommended that national emergency operations facilities should integrate technologies related to disaster risk assessment and emergency response. Furthermore, it recommended that such facilities should address all issues of collaboration, convergence, networking and integration of Earth observation and communication technologies under one umbrella in order to facilitate effective disaster risk reduction and emergency response operations.

48. The Conference recommended that the potential of the private sector should be drawn upon in the development of modern technologies to benefit disaster risk reduction and emergency response efforts, especially for those undertaken in more complex urban environments, where building resilience is much more challenging.

49. It was noted that space technology offered promising results with respect to understanding disaster risk, early warning, damage assessment and improved reconstruction efforts. The Conference advocated using technologies such as Earth observation, global satellite navigation and satellite communication to facilitate disaster planning and risk reduction, because they provide the greatest return on investment.

50. The Conference recommended that the scope of event warning and detection carried out by means of Earth observation systems should be increased to include greater geographic extents and multiple hazards through the use of integrated approaches that collaboratively connect a broad spectrum of users.

VI. Conclusion

51. According to the feedback given by participants, the Conference was successful in generating thoughts and ideas on building resilience through integrated applications. By bringing together disaster managers and technical specialists, the Conference served to raise the awareness of technology providers and end users of the importance of considering integration at all levels, including for policy and technical matters.

52. The Conference served to deepen the participants' understanding of thematic priority 6 of UNISPACE+50 through discussions on a wide range of issues, tools, technologies and trends related to the integration of space and in situ data, and was of benefit both to technical experts and to administrators involved in the development of disaster management policies.

53. The Conference provided exposure to best practices that had been adopted by international initiatives and mechanisms and that could be beneficially replicated at the national level, and such exposure could be particularly valuable for countries still developing capacity in the use of space-based technologies.

54. In conclusion, the observations and recommendations formulated at the Conference were valuable to efforts to define the way forward for UN-SPIDER in the context of UNISPACE+50 and the "Space2030" agenda. They fed into the wider efforts of the Office for Outer Space Affairs to enhance the benefits of space technology for Member States, in particular for developing countries, and to assist them in reaching their goals in disaster risk reduction and sustainable development.